

might be found in the division of all papers for Section A into two classes—papers that are generally intelligible and papers that are not—and in relegating the latter class only to subsectional meetings. It is not impossible that this might have beneficial results in more ways than one.

The address of the chairman, Prof. Schuster, has already been printed in full. His criticisms of mere routine observation raised an interesting discussion, in which the meteorologists reserved their defence.

Among the papers submitted to the subsection were several of general interest. Major S. G. Burrard, R.E., described the difficulties which are caused in the Geodetic Survey of India by the attraction of the mass of the Himalayas and the Thibet plateau, and by the existence of an underground chain of excessive density which runs across India. Contrary to the opinion that was held until a few years ago, it now seems certain that the plumb-line is deviated over the whole of India, and that all astronomical latitudes may be in error by a number of seconds of arc. The Government of India and the staff of the Survey must be congratulated on their good fortune in being confronted with problems of such interest and importance. Prof. Turner described an attempt made at Oxford to verify the suggestion put forward by Sir David Gill that the bright stars, as a whole, are rotating relatively to the fainter stars. From the Oxford astrographic catalogue plates he finds distinct evidence of such an effect, but with a sign opposite to that found by Gill in the southern hemisphere.

The feature of the meeting on September 16 was an exhibition of photographs from the Yerkes Observatory. Mr. Ritchey has made a most interesting set of pairs of photographs of star clusters, made respectively with a 2-foot reflector and with the 40-inch visual refractor fitted with a colour screen used in contact with isochromatic plates. With the latter, the densest parts of the clusters are beautifully resolved and measurable. The photographs of nebulae made with the 2-foot are unsurpassed; and it is remarkable how, though nearly all the detail which they show can be found on the photographs taken at Crowborough and Daramona and Greenwich, the general effect is in some cases quite different. Mr. Percival Lowell sent three papers, one describing a scheme for sending expeditions in search of good "seeing." Mr. S. A. Saundar discussed the possibility of changes in the surface of the moon, and urged the need of cooperation in the work of describing minute detail. Mr. W. E. Wilson reported failure in his search for Forbes's hypothetical extra-Neptunian planet, and showed a bolometer mounted equatorially for measuring solar radiation.

Other papers read at the meetings of the subsection have already been mentioned in NATURE in the notes of mathematical and physical papers.

A. R. H.

ZOOLOGY AT THE BRITISH ASSOCIATION.

ON September 11, in addition to the reports of committees, a short series of fisheries papers was taken:—

(1) Prof. McIntosh, who was prevented from being present, sent a detailed paper discussing British fisheries investigations and the international scheme, which was read in abstract to the meeting by Mr. W. S. Green, Chief Inspector of Fisheries for Ireland. He showed the necessity for improved statistics and for a careful survey of the off-shore and in-shore fishing grounds. He considered that hydrographical work occupied too prominent a position in the international scheme and that other more important points in connection with the distribution of fish have been omitted. (2) Mr. W. Garstang then read a statement as to the proposed programme for the international investigation of the North Sea, as passed at the recent meeting of delegates at Copenhagen. He stated that in his opinion all the investigations thought desirable by Prof. McIntosh and other critics were included in the Christiania scheme, and that that scheme was going to be carried out practically unchanged. He explained that the Government had had to adopt hydrography as a part of the proposed programme, although its importance in connection with English fishery interests might be doubtful. Finally, he urged the advantages of international cooperation. (3) Dr. Noel Paton, who was prevented from being present, sent a paper criticising the methods proposed in the international scheme, and throwing doubt upon the accuracy and value of results based upon such methods. Dr. Masterman, Dr. Mill and others spoke in the

discussion which followed. (4) Mr. J. Stuart Thomson had paper on the scales of fishes as an index of age.

The following were the reports of committees submitted to the Section:—

(1) "Migration of Birds," mainly the work of Mr. W. Eagle Clarke on the fieldfare and the lapwing. (2) "Naples Zoological Station," containing reports on work by Mr. E. S. Goodrich, Mr. N. McLaren, Miss A. Vickers and Dr. R. N. Wolfenden, in addition to the usual statistics from the station. (3) "Plymouth Marine Laboratory," with a short report from Mr. H. M. Woodcock. (4) "Index Animalium." Vol. i. of this work, by Mr. Sherborn, will be issued in October. (5) "Plankton Investigation." (6) "Zoology of Sandwich Islands." (7) "Millport Marine Zoological Station." And (8) "Coral Reefs of the Indian Region." Mr. Stanley Gardiner reports considerable progress with the publication of his results.

The forenoon of September 12 was devoted to a series of papers, by Prof. Herdman and those who are helping him to work out his results, on the fauna and flora associated with the pearl oyster banks in the Gulf of Manaar. First, Prof. Herdman gave a general account, illustrated by the lantern, of his recent expedition to Ceylon, with a description of the pearl fisheries. Then followed:—Mr. A. O. Walker, on the Amphipoda, Mr. I. C. Thompson, on Indian Ocean Copepoda, Mr. W. E. Hoyle, on the cuttlefishes, and Mr. J. Lomas, on the marine deposits dredged by Prof. Herdman. Prof. Dendy, Mr. Stanley Gardiner and others took part in the discussion that followed. The remaining papers before the Section that day were:—(1) Prof. Cleland, on a hitherto unrecorded element in the occipital bone of seals. (2) Prof. Poulton, on the habits of the predaceous flies of the family Asilidae, with exhibition of specimens. (3) Prof. E. W. MacBride read a paper on some new points in the development of *Echinus esculentus*. He stated that in order to obtain successful cultures of the larvae it was necessary to use perfectly ripe parents and to supply the growing larvae with an abundance of sea water, frequently changed. He pointed out that many cultures on which important conclusions were based were made under insanitary conditions. The cavity of the blastula was at first filled with a thick proteid solution which became thinner as development advanced, and this thinning was possibly connected with the infolding processes in the wall, by means of which the organs of the larva were built up. The larva showed its relationship to Tornaria by the three-fold division of the body cavity on each side and by a larval brain, which was situated at the front end and was independent of the ciliated band. The development of the nerve-ring of the Echinus from the floor of an ectodermic pit was described. A false floor formed over this by the meeting of interradial ridges gave rise to the buccal membrane of the adult. The masticatory apparatus was derived from five pocket-like outgrowths of the left posterior body cavity. Finally, the blood system was a remnant of the proteid contents of the blastocoel added to by exudation from the cells of the alimentary canal. (4) Dr. A. T. Masterman exhibited a series of wax models illustrating the transition from larva to adult in *Cribrella oculata*. The main points brought out were the complete bilaterality of the larva, the sinistral asymmetry followed by axial symmetry converting the larva into adult, and the absence of any true metamorphosis. The changes in the body cavities were shown to agree with the results of Goto for Asterina and Asterias, and to differ from those of MacBride. (5) Dr. J. Hume Patterson gave an important communication, on the causes of salmon disease—a bacteriological investigation, in which he showed that if a sound salmon is placed in water with *Saprolegnia* there is no result, and that the fungus is effectual only after a preliminary softening of the skin by the action of a bacillus which he had succeeded in isolating and cultivating.

On Monday, September 15, the following papers, &c., were taken:—

(1) Prof. Howes exhibited, on behalf of Mr. J. P. Hill, of Sydney, photographs of the first segmentation stages of the zygote of the native cat (*Dasyurus*) up to the period of first formation of the endoderm. A 16-celled stage was described, at which the embryo-cells are arranged in a couple of annuli, and later a stage suggestive of over growth of a yolk by the ectoderm. Selenga's blastopore stage was shown to be conspicuous, and in one example the endoderm appeared to arise from a single cell at the point of closure of the blastopore, after the manner of that of *Didelphys*. Mr. Hill has succeeded in obtaining microscopic

sections of the earlier stages by affixation of the egg to the embryonic membrane of the pig. (2) Prof. J. C. Ewart gave an account, illustrated by the lantern, of some recent inter-crossing experiments with dogs, and pointed out that unless one of the parents was highly prepotent, the first crosses were not as a rule uniform, and that when the members of the cross-bred litters were interbred, some of the offspring very closely resembled the pure-bred grandparents. (3) Mr. Nelson Annandale had a paper on flower-like insects from the Malay Peninsula, and Mr. H. C. Robinson, who had been on the same expedition, gave notes on protective resemblance—both subjects being illustrated by lantern slides. (4) Prof. Poulton then gave lantern exhibitions (1) of British insects in their natural attitudes, and (2) of three-colour slides showing mimicry, protective resemblance, seasonal forms of butterflies, &c. (5) Mr. Thos. Steel exhibited an interesting collection illustrative of Australian zoology, such as the different species of *Peripatus*, including forms of *Ooperipatus* which lay fertile eggs having a lengthy period before hatching; also a fine series of land Planarians, also marsupial embryos, the blind marsupial mole, *Notocytetes typhlops*, and the honey ant, *Camponotus infatus*, both from the Central Australian desert. (6) Prof. R. J. Anderson gave two notes—one on a specimen of the pilot whale of a white colour, with twenty-eight teeth and a large foramen of Winslow in the abdomen; and the second on the relations of the parietal bone in Primates. He showed that the orang is in a variable condition, having sometimes, but not always, a parieto-sphenoidal suture. Other variations were discussed. (7) Mr. A. T. Watson gave a most interesting account, illustrated by the lantern, of the errant habits of the Onuphidæ (Polychæta), and described a defensive mechanism which he had discovered in the tubes. The onuphid worms drag their tubes over the sea-bottom, and protect the open ends by constructing membranous valves, like those of the veins, and so arranged that on retreat of the worm the inrush of sea water causes the valves to close automatically. (8) Mr. R. T. Leiper, on an acelous Turbellarian inhabiting the common heart urchin: The worm was found in the accessory canal of about 5 per cent. of the *Echinocardium cordatum* at Millport. It is white, leaf-like, and 2·5 mm. in length. There is no spermatheca or vagina. A similar absence of female accessoria obtains in *Haplodiscus*, from which this Turbellarian differs in the following respects:—(1) shape; (2) parasitic habitat; (3) mouth in anterior fourth; (4) paired lateral testes; (5) no defined vasa deferentia; (6) penis with chitinous knob-like armature; (7) large digestive vacuole. In discussing the classification of the Accela, the author suggests that the family Proporidae, comprising all Accela with one genital opening, be subdivided to form two subfamilies:—(1) Proporidae, to include the genera (a) *Proporus*, (b) *Monoporus*, (c) *Böhmigia*, i.e. those with a common genital pore; (2) Avagininae, consisting of (a) *Haplodiscus* and (b) the genus now recorded, i.e. those having a male pore only. The name *Avagina incola* is proposed for this new form.

On the Tuesday, Dr. Henry Woodward gave a note on a diagram of the skull of *Mastodon angustidens*. Dr. R. F. Scharff had an interesting paper on the Atlantis problem, in which he collected a number of facts in the distribution of animals bearing upon the possible land connection between Europe and America by way of the Atlantic islands. His investigations tended to show that Madeira and the Azores are the remains of an ancient Tertiary area of land which was joined to Europe, and that it probably became disconnected in Miocene times. As to a land bridge across the Atlantic, many reasons can be given in its favour. Uniting North Africa with Brazil and Guiana in early Tertiary times, it probably subsided during the Miocene period, leaving only a few isolated peaks as islands.

Mr. R. J. Ussher gave an interesting address, illustrated by lantern photographs taken by Mr. R. W. Welch, on the avifauna of Ireland as affected by its geography. He shows that as a result of the position and features of the country, some species breed more numerously and extensively than in England. The buzzard, bittern and capercaille have been exterminated, and certain other British birds have never established a footing in Ireland. Winter and occasional visitants were discussed, also the list of North American species taken in Ireland. The raven, harriers and eagles are approaching extinction. The bones of the great auk found in kitchen middens in Antrim show that it was used as food.

Mr. E. J. Bles gave two communications, one on the development of *Xenopus*, and the other on experiments on the Axolotl, showing adaptations to life in an alkaline medium. Dr. H. W. Maret Tims had a paper on the structure of the scales in the cod. Prof. C. S. Minot, of Boston, U.S., gave an address on the significance of the embryonic cell, in which he gave the results of his observations on cellular development in guinea-pigs, mice and rabbits. Mr. J. Stanley Gardiner had a paper on the breaking up of coral rock by organisms in the tropics. First the boring alge and sponges penetrate the living corals, extending into every septum and spine. They weaken the coral and so riddle it that it is then easy for boring Polychæta such as *Polydora* and *Enicte* to enter. Following these come various Sipunculids, the bivalve *Lithodomus* and the cirripede *Lithotrya*. Then a wave breaks off the coral mass, leaving a bare surface, which more boring animals at once take advantage of. The fallen coral mass is finally broken down into smaller and smaller fragments by the boring animals. Then the sand-feeders come into action and grind up the coral fragments into sand. Chief among these may be mentioned the sea-slugs, *Holothuria atra* and *Stichopus chloronotus*, which appear to retain within their guts the coarser fragments in the sand for long periods of time, while the finer particles are swept out along the ciliated grooves. Other sand-feeding forms are Sipunculus, *Echinus* and *Ptychoderma*, the mound-like casts of the latter of which form most conspicuous features of the landscape at low tide. Much of the finer material must pass into suspension in the water and be swept out by the tidal and oceanic currents, while the smaller the sand grains the greater the area they present for solution. It will thus be clear what an important bearing the sand-feeding and boring animals have on the formation of the lagoons of atolls.

Mr. J. Graham Kerr communicated a paper, illustrated by microscopic preparations, on the early development of muscles and motor nerves in Lepidosiren. He described a stage in which the inner wall of the myotome consisted of a layer of large neuromyoepithelial cells, the cell substance of each of which was continued into a tail-like process, which was in turn continuous with the nerve rudiment. The outer wall of the myotome was shown to contribute largely to the formation of the myomere. Mr. Kerr's preparations showed that the connection between spinal cord and myotome existed at a very early period—while the two structures were still in contact—and that these primitive connections—the rudiments of the motor nerve-trunks—became gradually drawn out and lengthened as the myotome receded from the spinal cord with the interposition of mesenchyme. The motor nerve-trunk, at first naked, became later on surrounded by a sheath of mesenchymatous protoplasm.

Mr. G. H. Carpenter, of the Dublin Museum, read a paper on the insect fauna of some Irish caves, dealing especially with *Collembola* discovered in Michelstown Cave, co. Tipperary, and in Dunmore Cave, near Kilkenny. With the exception of *Heteromurus margaritatus*, Wankel, which has now been found to inhabit caves in Ireland, France and southern Austria, all the blind species enumerated occur in above-ground localities (albeit with a discontinuous range) as well as in various caves in continental Europe. These facts point to the conclusion that such insects may be regarded as the survivors of ancient races with wide distribution whose ancestors were destitute of eyes; now almost exterminated in the upper world by the competition of eyed forms, they still survive in the caves. This conclusion does not, of course, contradict the generally accepted view that a large proportion of the blind cave fauna of continental Europe and North America (probably including *H. margaritatus* mentioned above) must be descended from eyed ancestors.

On Wednesday forenoon there was an interesting discussion on natural selection in relation to protective resemblance and mimicry in animals, arising out of the communications made to the section by Prof. Poulton and by Messrs. N. Annandale and H. C. Robinson. Prof. Poulton, in opening the discussion, expressed his conviction that natural selection was the key to the puzzle, although it was not always possible to say how it should be applied. He gave examples of some mistakes that had been made in the past, and since rectified in attributing utility to characters. He alluded to the results he had obtained from the destruction of chrysalides in different environments, and he finally accepted natural selection as a working theory. Mr. Annandale and Mr. Robinson both brought up various cases observed by them in Siam and Malaya where the

explanation by natural selection seemed very difficult. Mr. G. H. Carpenter pointed out how some of these cases might be explained. Miss M. Newbiggin and others also brought up further difficulties, and some speakers discussed natural selection as a form of isolation and as being of less importance than other forms. In his reply, Prof. Poulton dealt with many of the cases cited, and showed how they could be brought under the operation of natural selection.

Finally, a paper by Mr. C. Shearer, on the early development of the head kidney in *Polygordius* and *Eupomatus*, and the usual votes of thanks to the president and officers brought a very successful meeting of Section D to a close.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE changed spirit that is coming over geography was in evidence at Belfast. Accounts of explorations proposed or executed were limited in number, and half of them related to the unknown Polar lands. On the other hand, papers dealing with the morphology of limited areas and with applications of geographical knowledge to economic problems, branches of geography which are rapidly growing in importance, this year outnumbered the accounts of pioneer travels.

The president, Sir Thomas Holdich, in his address on the progress of geographical knowledge, emphasised the fact that the area for pioneer work was rapidly diminishing, and that the exploration required was of a more exact and comprehensive character, which necessitated a more restricted scene of operations. He very properly insisted on the need for an exact knowledge of the previous work done in any region before attempting to carry out new investigations in it, and that the investigators should be thoroughly trained men. In much of the world, a topographical knowledge is wanted intermediate between that given by pioneer surveys and that of elaborate national surveys such as our ordnance survey, *i.e.* a knowledge sufficient to show on a fair scale the salient features, and capable of being adjusted to the triangulation of a geodetic survey. Following a recent American authority, Sir Thomas Holdich called this a geographical as opposed to a topographical survey. As geographical survey means a survey of the distribution of all phenomena within a selected area, and not merely of its topographical features, it would be well to find another term. Topography and geography are too often considered synonymous, and it does not help to an appreciation of the true significance of geography to identify it with a topography. Why not simply say large- and small-scale topographical surveys? The president of Section E is the last man to limit geography to topography, as many paragraphs in his address showed, although as a surveyor of long and special experience he naturally dwelt most fully on map making.

The travel papers were of a high standard. The audience had to listen, not to uninteresting extracts from diaries, but to well-digested summaries of results. Major Molesworth Sykes discussed the geography of southern Persia, in a paper which might equally well be classed among those applying geographical knowledge to practical needs. He pointed out the influence of the dry, barren conditions of southern Persia and Baluchistan, bounded by an inaccessible coast and so escaping invasion from the sea, in determining a hardy, warlike race, which has held in subjection the plains of Mesopotamia and even of India. He traced the influence of physical features on trade routes and the new telegraph line. Part of his paper was a contribution to physical geography, for it dealt with the changes of the bed of the Helmand River. He remarked that the desert of Lut is traditionally associated with Abraham's nephew, and condemned our maps for distinguishing between it and the Dasht-i-Kavir, as Kavir is the name of Arabic origin applied to all saline portions of Dasht-i-Lut, the general name for the whole desert area. A very serviceable paper was communicated by Captain Ryder on hilly Yünnan, in which the possibility of the much-discussed railway line from Burma was not denied, though its utility or financial success was. The natural route was by the Red River through Tongking, and a railway would soon be ready through the French territory. Mr. Hawes, an energetic young Cambridge graduate, told us how he could find out so little about Sakhalin that he visited it to discover for himself what it was like. It is almost as long as from the Shetland to Land's End, rises to about 5000 feet as Great Britain does, has two

rivers each about 300 miles in length, and is covered with the forest primeval, wherein bear, wolf, fox, sable, reindeer and other animals wander. The climate is one of extremes, but popular ideas about a perpetual fog enshrouding it must be abandoned. The natives are the Ainus, Gilaks, Orochons, Yakuts and Tunguses, but the majority of the inhabitants are Russian exiles, few of whom are political prisoners. The Rev. W. S. Green brought us to a little island nearer home and showed views of Rockall. Prof. Libbey, of Princeton University, described his recent visit to Petra and showed magnificent views of its impressive rock temples, tombs and still older "high places" of Moab, and of the gorges through which this depression is reached.

Prof. Libbey read a prophetic note from Sir Clements Markham on the Sverdrup North Polar Expedition, and subsequently gave a graphic account of the expedition to renew Peary's supplies two years ago, in which he took part. Both communications expressed belief in the safety of these explorers, and were verified within a few days. Interest, however, was concentrated on the South rather than on the North Polar regions. Dr. Mill gave one of his admirably lucid expositions, in which he traced the sequence of ideas about a great southern continent and the various phases of Antarctic exploration. A crowded audience listened to Mr. Bruce's account of the plans of the Scottish National Antarctic Expedition, which will concern itself mainly with oceanographical and meteorological investigations, for which it is exceptionally well equipped. Much is hoped from the kite flying by the meteorologists, for which elaborate apparatus has been provided. The audience sympathised greatly with Mr. Bruce, who has unhappily found himself compelled practically to rebuild his ship, the *Scotia*, at the cost of transforming an estimated surplus of 2000*l.* collected above the sum required for the expenses of one year's work into a deficit of 4000*l.* A grant of 50*l.* was voted by the Association to the expedition.

Of physical papers, that which attracted most attention was Prof. J. Milne's account of world-shaking earthquakes, with special reference to the recent volcanic eruptions in the West Indies, of which 93 per cent. are submarine. He associated periods of volcanic activity with periods of upheaval, and those Antillean eruptions of which we possess records with huge readjustments of the Hispaniola-Jamaica fold or of neighbouring folds on the American continent. A report was read by the Committee on Terrestrial Surface Waves and Wave-Like Surfaces, which was drawn up by Dr. Vaughan Cornish, whose well-known recent work was outlined in it.

Prof. Libbey discussed the evolution of the Jordan Valley, the origin of which he traced to a rift at the close of the Cretaceous period. It was subsequently widened and deepened by ice action to the Sea of Galilee, if not throughout its whole length; then submerged nearly as far north as the Sea of Galilee and covered with 4000 feet of sedimentary deposits, which were afterwards gradually elevated, the stream cutting its bed through them the while. Some 3000 feet of this sedimentary rock were removed when conditions altered, and probably the glacier disappeared or the water supply failed, or the rate of elevation increased, or all three took place and connection with the ocean was blocked. After 1000 feet of rise, the present conditions were obtained. Mr. Herbertson read a note on the windings of the Evenlode, and suggested that we must look some 150 feet above the present level, where the river flowed over Oxford Clay, for their initiation. Mr. Porter traced the origin of the valleys of county Cork, which change abruptly from one strath to another, to glacial interference, and explained the meridional character of many tributary glens as the outcome of faulting plus the rapid flow of pre-Glacial streams. Prof. W. W. Watts described the features of Charnwood Forest, where old mountains rise above Triassic deposits which cover their lower slopes, these slopes being here and there exposed in the river valleys. He compared the Triassic landscape in Charnwood Forest with that of the Great Basin of North America at the present day.

A report was read from Dr. T. N. Johnston on the Scottish Lakes Survey, in which the seiches which have been recently observed were described and illustrated by curves. (See NATURE, June 12.)

The only paper on biological geography was that by Mr. Lloyd Praeger on geographical plant groups in the Irish flora. A careful analysis of the distribution of plants in Ireland reveals the existence of several fairly well-defined types. There is a marked tendency to a "central" or "marginal" distribution, the result of the configuration of the country, the central group